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PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Methods of Inserting Substances into Resilient Porous Materials

We, GEORGE NEVILLE GEE, of Kirkland Acre, Churchtown, Garstang, Lancashire, and CHARLES REGINALD GEE, of Low Wood, Mereside Road, Mere, Near Knutsford, Cheshire, both British subjects, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to methods of inserting substances into resilient porous materials and to the articles thereby produced. The term "porous material" is used hereinafter and in the appended claims to include not only material which are inherently porous but also material which are not inherently porous but which become porous during carrying out of the invention, an example of the latter being synthetic plastics materials with non-interconnected cells.

According to the invention there is provided a method of inserting a substance into a resilient porous material comprising subjecting the resilient porous material to compression in those areas not required to have the substance inserted therein and injecting the substance into the remaining areas of the material.

Compression is preferably applied by means of co-operating dies, the material in the die cavities being subjected to less compression than the remainder of the material. The substance is preferably injected under pressure by an injection nozzle.

The material is preferably a foamed synthetic plastics material of the type in which the cells or cavities in the material are interconnected to a large extent, for example, polyurethane foam. The inserted substance must be one which will flow on insertion, for example a paste or powder, or a liquid of high viscosity or one which solidifies within the material, for example due to chemical, thermal or evaporative action.

An exemplary use of the invention is the insertion of soap, detergents or the like into polyurethane foam to provide a cleaning product requiring only the addition of water to provide a lather. Methods of achieving this will now be described, by way of example only, with reference to the accompanying diagrammatic drawings, in which:—

Fig. 1 is a perspective view of a die;

Figs. 2 and 3 are sections on lines A-A and B-B in Fig. 1;

Fig. 4 is a plan view of a modified die; and

Figs. 5 and 6 show two injection techniques.

In carrying out the method to insert soap into polyurethane foam, a sheet of the foam is clamped between two dies such as that shown in Fig. 1. Each die has a main die cavity 5 and an inlet channel 6 and when the dies are pressed together the foam is very highly compressed so as to be virtually solid except in the cavity and channel where the compression is much less and the cellular nature of the material is retained.

With the dies closed soap under pressure may be injected through the foam by way of inlet channel 6 to the cavity 5. Due to the pressure applied by the dies the resistance to flow of the soap is greater at the edges of the inlet channel and cavity than at the centre and hence the soap flows generally centrally through the foam in the channel 6 and collects generally centrally in the cavity 5. After injection the dies are removed either before or after the soap sets. The foam sheet then returns substantially to its original shape and exhibits only slight distortion due to the presence of the soap. In fact there may be no apparent distortion.

The cross-sectional shape of the inlet channel should preferably be as near to circular as possible though complete circularity is difficult to attain due to the pull on the foam at the edges of the channel and die. The generally oval cross-section shown in

the drawings has been found to be the most satisfactory. However, the shape or size of the cross-section may be altered to suit the viscosity of the substance being inserted and the injection pressure.

It is also important to endeavour to inject the soap precisely in the centre of the inlet channel or it may penetrate to the outer surface of the foam. An effective seal is required and may be achieved by providing a generally conical lead-in to the channel 6 as shown at 7 in Fig. 5. The foam bulges under the pressure of the dies to the position shown in dotted lines and an injection nozzle 8 may be pressed into the cone thereby forming a continuous seal as indicated by the heavy lines. An alternative technique is shown in Fig. 6 where the bulging foam is flattened by an apertured plate 9 which may be a separate item or can be part of the die assembly. The plate is dished at 10 to receive the injection nozzle, and the compressed foam forms a continuous seal indicated by the heavy lines. If desired a centralized puncture may be made through the inlet channel and into the cavity before injection.

The amount of soap injected may be determined by control of the injection pressure or a predetermined quantity related to the dimensions of the material may be inserted. If too much soap is inserted the shape of the final article may become distorted.

Various modifications are possible. Thus, the dies shown are of the simplest form and in large scale production injection of the substance into a number of dies in series may be effected from the one injector, the finished articles being severed from one another after removal from the dies. Alternatively, a number of cavities may be formed in the one die assembly as shown in Fig. 4, all the cavities being supplied with the injected substance from a common inlet channel. This makes available a greater surface area of the inserted substance so that in the case of soap, it will lather more quickly. It also provides an improved surface distribution of the lather compared with the Fig. 1 arrangement.

The invention has a great many applications apart from injecting soap into foamed plastics material. Any suitable substance may be inserted into any resilient porous material. For example, packing materials may be produced by inserting hardenable plastics material into polyurethane or similar foam, the plastics material being in layers having different impact resistances. Furniture may be constructed by suitably shaping the body from a resilient porous material and subsequently inserting a hardenable substance to form the framework. Substances which are releasable by a release agent can be inserted; thus soap is releasable by water and paint by turpentine solution. Substances which will work their way through the porous material can be inserted, for example emery powder, graphite or boot polish. Water softeners, perfume, moisture inhibitors, stain removers, soapless detergent and fire retardent materials are other examples of substances which can be inserted.

It is also possible for two or more substances to be inserted into the one carrier material in separate stages or in the same stage so that one forms a coating or framework round the other or the two are mixed together. One such substance might form a protection for the other or the substances could react together on application of a suitable agent. In a further application a lifeboat or a floating rescue mat on to which people could jump from a ship may be made by inserting buoyant material into a suitable resilient carrier. A noise inhibitor may also be inserted, forming a material having many uses in the automobile, aircraft and other industries. Where two or more sequential injections were involved a corresponding number of moulds would be used. Where two substances were injected together, more than one inlet channel may be provided.

Various materials may be used as the carrier apart from polyurethane foam. For example, other expanded or foamed plastics materials may be used, natural sponge, or any other resilient, porous material. Resiliency is necessary to enable compression in the die and spring back after compression, and porosity is necessary to enable insertion and release of the inserted substance. A material which is not naturally porous may be used such as a synthetic plastics material having non-interconnected cells. In such a case, when the material is compressed between the dies, air pressure in the cells ruptures some of the cell walls thereby interconnecting the cells and rendering the material porous. Injection of the substance will also cause rupture of cell walls to allow the substance to enter the material.

Moreover, while it is preferred to inject the substance using an injection nozzle, insertion of the substance may be effected in other ways, for example, by means of a needle or by a nozzle which is elongated to effectively form a tubular needle.

WHAT WE CLAIM IS:—

1. A method of inserting a substance into a resilient porous material comprising subjecting the resilient porous material to compression in those areas not required to have the substance inserted therein and injecting the substance into the remaining areas of the material.

2. A method according to claim 1, in which compression is effected by means of co-operating dies defining at least one cavity

and inlet channel therebetween, the material in the die cavities being subjected to less compression than the remainder of the material.

3. A method according to claim 2, in which injection is effected into a number of dies in series from a common injector, the articles so produced being severed from one another after removal from the dies.

4. A method according to claim 2 or 3, in which a number of cavities are formed in the one die, all the cavities being supplied with the injected substance from a common inlet channel.

5. A method according to any one of claims 2 to 4, in which more than one inlet channel per cavity is provided.

6. A method according to any preceding claim, in which two or more substances are inserted sequentially or together into the one carrier material.

7. A method according to any preceding claim, in which the substance is injected under pressure by an injection nozzle.

8. A method according to any preceding claim, in which the material is a foamed synthetic plastics material having interconnected cells.

9. A method according to claim 8, in which the material is polyurethane foam.

10. A method according to any preceding claim, in which the inserted substance is a liquid of high viscosity or one which solidifies within the material by chemical, thermal or evaporative action.

11. A method according to any one of claims 1 to 9, in which the inserted substance is a paste.

12. A method according to any one of claims 1 to 9, in which the inserted substance is a solid in powder form.

13. A method according to any preceding claim, in which the inserted substance is soap.

14. A method according to any preceding claim, in which the material is punctured to assist injection of the substance.

15. A method according to any preceding claim, in which the amount of substance inserted is regulated relative to the dimensions of the material such that when compression is removed the material exhibits no or only slight distortion due to the presence of the inserted substance.

16. A method according to any one of claims 1 to 14, in which the amount of substance inserted is determined by control of the injection pressure.

17. A method of inserting a substance into a resilient porous material substantially as hereinbefore described.

18. An article of manufacture when produced by the method of any one of the preceding claims.

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1180995 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

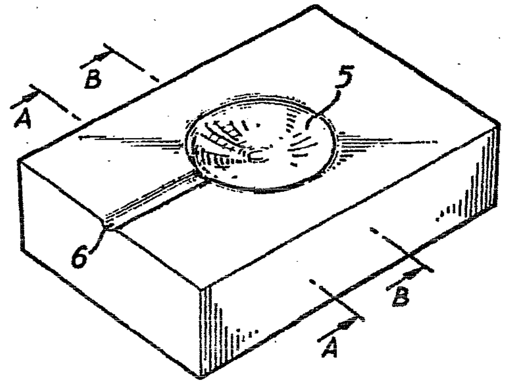


FIG.1.

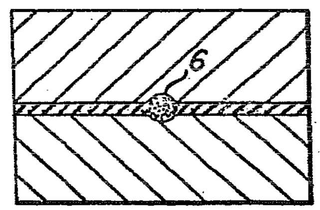


FIG.2.

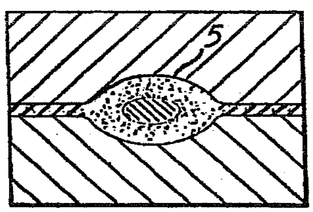


FIG.3.

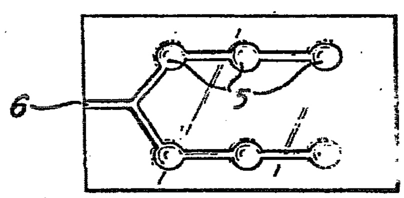
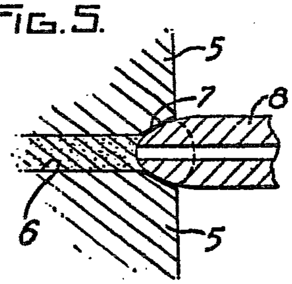


FIG. 4.

FIG.5.



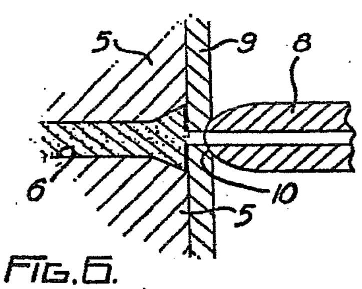


FIG.6.